Apomyelois bistriatella: A Moth Which Feeds in an Ascomycete Fungus (Lepidoptera: Pyralidae)

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Abstract: *A. bistriatella* (Phycitinae), a moth formerly recorded in the eastern United States, has been found to occupy diverse situations in California, feeding in the larval stage on stromata of *Hypoxylon occidentale* (Xylariaceae). The moth was not recovered in extensive sampling of Polyporaceae, while records indicate that other species and perhaps other genera of Xylariaceae are used.

During the past several years a large number of collections of wood-rot fungi from the western United States and Mexico have been processed for insect material. Early phases of the program were conducted primarily by J. F. Lawrence, now of the Museum of Comparative Zoology, Harvard University, who surveyed primarily for Ciidae (Coleoptera). In the last three years an increasing emphasis has been placed on moths, the larvae of which inhabit these fungi. An analysis of host ranges of the Microlepidoptera (Oecophoridae, Oinophilidae, Tineidae) has been prepared (Lawrence and Powell, 1967). A summary of all productive fungus species involved in our collections is given in that paper.

Although Polyporaceae (Basidiomyceteae) comprised about 90 per cent of the 480 lots processed, an assortment of other wood-rot fungi was included. Thus, several Thelephoraceae species including some 20 collections and a few lots of Agaricaceae, where these had developed somewhat hardened sporophores, were involved. All of these are members of the Basidieomyceteae, and the only other fungus involved was *Hypoxylon occidentale* Ellis and Everhart,[2] (Ascomyceteae:Xylariaceae). The sporophores, or stromata, of this species are carbonous appearing, hemispherical, about 2 to 4 cm in diameter (Plate I) and are commonly seen on recently killed *Quercus agrifolia* throughout the coastal foothills of California. Although several species of Tineidae and Oecophoridae were reared from this fungus, it was concluded that it is only an incidental host because the stromata are hard and dry during several months each year. None of the ciidae use *H. occidentale.*

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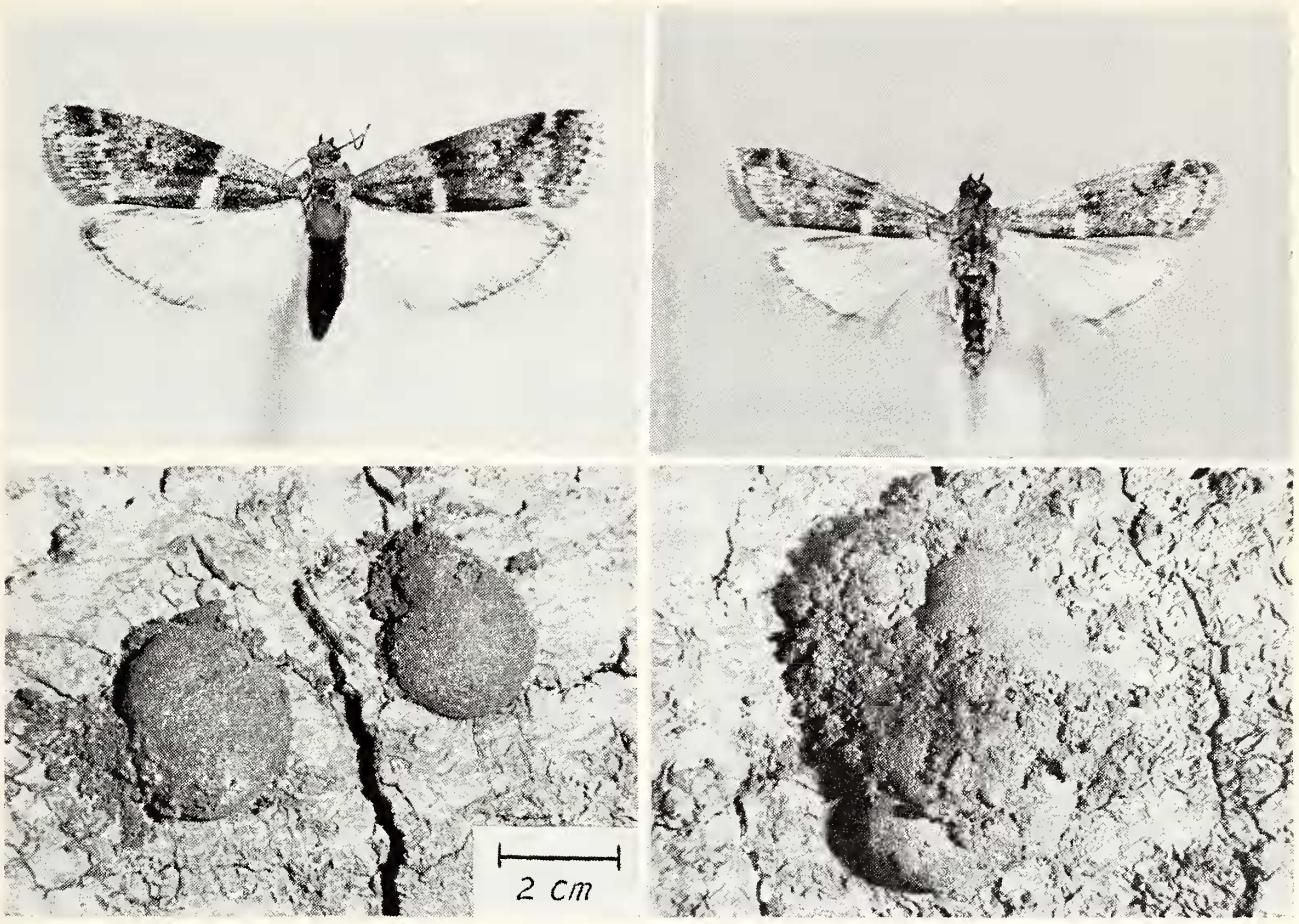
[2] *Hypoxylon occidentale* has been treated as a synonym of *H. thouarsianum* (Lev.), a widespread Neotropical and Nearctic species described from the Galapagos Islands (Miller, 1961). For the present discussion the name *occidentale* will be used for the California-Oregon segregate.



Upper: *Apomyelois bistriatella* (Hulst), female (left) and male (right) from Lone Pine, California, reared from *Hypoxylon*. Actual size: ♀ 23.5 mm, ♂ 21.0 mm, wing expanse. Lower: Stromata of *Hypoxylon occidentale* (Ascomyceteae, Xylariaceae) on bark of *Quercus agrifolia* from Berkeley, California, showing frass exudations due to feeding of the moth larvae. The 2 cm scale applies to both lower photos.

In the fall of 1961 a collection of *Hypoxylon occidentale* produced two adults of a large phycitid moth. It was assumed that these individuals had only an incidential association with *Hypoxylon*, perhaps using it as a scavenger or for a pupation site, since Heinrich (1956) lists no American Phycitinae as fungus feeders. However, subsequent collections of this moth, *Apomyelois bistriatella* (Hulst), indicate that *Hypoxylon* is a normal host for the larvae. Moreover, *Apomyelois* was not encountered in any other of the wood-rot fungi which we processed, indicating that the moth is specific to *Hypoxylon*.

Apomyelois bistriatella (Hulst)

Dioryctria bistriatella Hulst, 1887, Ent. Americana, **3**:136.
Apomyelois bistriatella; Heinrich, 1956, U. S. Natl. Mus., Bull. **207**:43. (taxonomy).

The genus *Apomyelois* was proposed by Heinrich (1956) to accommodate the single, widespread but poorly known species, *bistriatella* Hulst, originally described from Washington, D. C. Heinrich had material of the species repre-

senting several widely scattered stations in the eastern United States and Canada. There was no information on the biology of this moth. Records in the California Insect Survey, University of California, Berkeley, show this species to be widespread ecologically and geographically on the West Coast.

ADULT: The moths are rather large, relative to many Phycitinae, having a wingspread of 20 to 24 mm. The forewing is dark gray, dusted with whitish, especially on the costal half, and is crossed by two white lines, one at the basal one-third, and a less distinct, somewhat sinuate one beyond the end of the cell (Plate I). Western specimens compare well with Heinrich's characterization of the species, both in external features and in genitalia form of both sexes. A pair of 60-year-old specimens from Ottawa, Canada, and Massachusetts, sent to me from the U. S. National Museum are paler and have less well defined markings, especially in the terminal area of the forewing. However, these differences probably are a function of the age of the eastern specimens. The eastern male has a more deeply cleft gnathos (possibly the slide upon which Heinrich's figure was based) than California examples (four preparations examined). If any of these differences are to be considered sufficient to warrant proposal of a nomenclature designation of the west coast race, this will have to be shown through comparison with typical material in series. The series from Inyo County, California, shows considerable variation in wing color and in size.

BIOLOGY: The life history of this insect is not clearly defined, and it may vary with climatic condition. In eastern areas flight records are available for May, June and July in the north and for March in Florida. Records of field collected adults in the California Insect Survey suggest that the species is multivoltine, the flight perhaps varying with weather conditions and growth of the host. In coastal areas of California the moths have been taken in late April, July, September, and October, and the larvae in May and October producing adults in June and November. At 3500 feet elevation in the Sierra Nevada adults have been collected in June and August.

Stromata of *Hypoxylon* appear in fall after the first rains and grow then and during winter. At this time they are relatively soft, having a consistency similar to damp charcoal, and can be crushed between one's fingers. Even in late spring, well after winter rains have ceased, visible moisture can be squeezed from sporophores situated in damp areas. During the dry season, however, the stromata harden and desiccate. In summer at most localities where *Quercus agrifolia* serves as a host the hemispherical sporophores are so hard they usually can neither be dislodged nor crushed by hand. Nonetheless, the entostroma is somewhat softer in texture and it appears that at least the larger larvae are able to feed at nearly any time of the year.

Neither eggs nor young larvae have been observed. Larger larvae fed in irregular galleries, usually beneath the thin, crust-like, perithecia-bearing sur-

face layer. Often the galleries were somewhat blotch-like, not extending through the whole depth of the entostroma. At times side tunnels radiated outward or more deeply towards the substrate. No evidence of a direct opening to the exterior was noted, and the burrows became filled with frass. The frass sometimes extrudes irregularly from the surface of the stromata (Plate I). In the field, the thin surface layer often later collapses or is broken away by external agencies, resulting in a characteristic shallow hollowed out area around the apex of the dome of the stroma. I have noted these evidences of larval feeding at a number of California stations in addition to those from which the moths were reared.

No larvae were found to burrow into the bark subtending the *Hypoxylon*, although they may sometimes wander under normal conditions and seek out crevices, insect burrows, etc. for pupation. In the laboratory pupation usually took place in the burrows, either just under the thin, ectostromal layer and parallel to it, or occasionally in a deeper gallery, perpendicular to the surface. Some individuals formed the loose silken cocoons amongst debris in the rearing container, between *Hypoxylon* pieces, etc. One individual pupated in an abandoned cerambycid gallery some 4 cm from the emergence hole of the beetle. This exit was also successfully used by the moth upon emergence.

GEOGRAPHICAL DISTRIBUTION: Available records show a disjunct range, in eastern North America from Ontario and Wisconsin to the District of Columbia and Iowa, in Florida (Heinrich, 1956) and in California. The diverse ecological situations occupied by the species in California are not representative of austral or boreal distributional patterns typical of many insects. Probably *Apomyelois bistriatella* occurs over much of temperate North America at intermediate elevations.

Specimens of *Hypoxylon* collected from *Populus* at Lone Pine were not submitted for identification, having been assumed to be *H. occidentale*. For *H. thouarsianum*, including *occidentale*, however, Miller (1961) states that *Celtis*, *Piersea* and *Quercus* are known hosts. Thus it may be that the Inyo County fungus was a different species. The range of *H. thouarsianum* in the eastern United States does not extend north of North Carolina (Miller, 1961), indicating that at least one additional host is involved.

Hypoxylon species with relatively bulky stromata (as opposed to species with little or no development of entostromal tissue) may be generally used. In addition, I have seen herbarium specimens of *Daldinea*, a related genus of Xylariaceae, with evidences of lepidopterous feeding, suggesting the possibility that *Apomyelois* uses ascomycetes other than *Hypoxylon*.

CALIFORNIA MATERIAL EXAMINED: Contra Costa Co.: Pleasant Hill, 1 ♀ IX-15-58 (W. E. Ferguson); Orinda, 1 ♀ X-11-61, at 15 watt blacklight (P. A. Opler); Walnut Creek, 1 ♀ VIII-5-65, 1 ♀ VIII-23-66 (J. Powell). Inyo Co.: 5 mi. W. Lone Pine 25 ♂♂, 33 ♀♀ VI-13-65, r. f. *Hypoxylon* on poplar, emgd.

VII-6 to VIII-1-65 (J. T. Doyen Collr; JAP 65 G5). Marin Co.: 1 mi. SE Inverness, 1 ♂, 1 ♀ X-8-61, r. f. *Hypoxylon occidentale* on *Quercus agrifolia*, emgd. XI-7 and XI-20-61 (C. W. O'Brien collr.; JFL 979); Inverness, 1 ♂ IX-8-62, at light (C. A. Toschi). Santa Barbara Co.: Prisoner's Harbor, Santa Cruz Island, 2 ♀ ♀ V-1-66, r. f. *Hypoxylon occidentale* on *Quercus agrifolia*, emgd. VI-7 and VI-13-66 (J. Powell, A. Slater, J. Wolf collrs.; JAP 66E4); Central Valley, Santa Cruz Is., 1 ♂ IV-28-66, at light (J. Powell). Sonoma Co.: Hacienda, 1 ♀ VII-9-61 (C. Slobodchikoff). Tuolumne Co.: Twain Harte, 1 ♀ VI-19-59, 1 ♀ VIII-18-60 (M. Lundgren).

Specimens are deposited in the collections of the California Insect Survey and U. S. National Museum.

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